

Montana Sagebrush B i b l i o g r a p h y



Montana Fish, Wildlife & Parks

ACKNOWLEDGEMENTS

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We also thank the sportsmen and women of Montana who have supported our agency in organized groups and as individuals in efforts to conserve Montana's wildlife habitat over many years.

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Montana Sagebrush Bibliography



***Montana Fish,
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Photo: R. Margaret Frisina



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Photo: R. Margaret Frisina



FOREWORD

The 1935-36 *Montana State Fish and Game Commission Biennial Report* states: *"To many people, the idea of wildlife management means only game wardens and closed seasons ...bounties on coyotes and cougar...and game preserves closed to hunters...but years of experience now indicate that modern wildlife management includes a far broader field of endeavor. It comprehends such problems as maintaining and improving the environment of the animal, ...as well as making provisions for a continuous supply."*

In the foreword of *Game Management in Montana* (1971), the Director of Montana Fish and Game Department states: *"Wildlife was, and is, dependent on the habitat."*

In the Pronghorn Antelope chapter of *Game Management in Montana*, three game managers - Buck Compton, Joe Egan and Dick Trueblood - state: *"Habitat is the key to the status and future of any wildlife population. Sagebrush and weeds are items essential in the year round pronghorn diet."*

From 1965 to 1975 Montana Department of Fish and Game and the Bureau of Land Management cooperated in the Sagebrush Ecology Project. One of the results of this 10-year study was Montana Fish, Wildlife & Parks (FWP) 1975 technical publication *Montana Sage Grouse*, which shows the indispensable link between sagebrush and sage grouse. Wynn Freeman, the Wildlife Division Administrator, states in the foreword: *"It is impossible to consider the future of sage grouse without considering the future of the sagebrush ranges they inhabit."* Or, to put it another way, the future of sagebrush is the future of sage

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grouse.

In FWP's 1987 technical publication *American Pronghorn Antelope in the Yellow Water Triangle, Montana*, Wildlife Division Administrator Arnold Olsen states: "*The almost inseparable alliance between antelope and sagebrush (Artemisia spp.) communities contributes to the uniqueness and vulnerability of these resources.*" The author, research biologist Duane Pyrah, recommends for habitat management "*protection from massive habitat conversions*". This is in relation to the loss of the big sagebrush community.

In FWP's 1989 technical publication *Ecology of Sympatric Populations of Mule Deer and White-Tailed Deer in a Prairie Environment* the authors note: "*Over all seasons and years, mule deer generally used sagebrush grasslands,...more than expected on the basis of relative availability..*".

In FWP's 1995 technical publication *Ecological Implications of Sagebrush Manipulation* author and wildlife manager Joel Peterson writes: "*The necessity and desirability of controlling big sagebrush has been strongly questioned from an ecological standpoint by renowned plant ecologists like G. Hormay and R. Daubenmire.*" The foreword of this document states "...*Montana Fish, Wildlife and Parks (FWP) believes sagebrush manipulation is too often initiated without proper understanding of effects on wildlife, wildlife habitat and the overall ecosystem.*"

The Department and its professionals have been consistent for over 60 years in stating the importance of habitat for wildlife, and in particular the sagebrush-grassland community.

This publication is intended to maintain the integrity of thought, add to the knowledge, and honor our predecessors in the struggle to end the destruction of sagebrush in Montana. It is time to heed the message.

Stephen J. Knapp
Habitat Bureau Chief
Montana Fish, Wildlife & Parks

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Photo: John White

INTRODUCTION

The Montana Sagebrush Bibliography was created as a reference source for those interested in the conservation of sagebrush plant communities and associated wildlife. The bibliography was designed with the Montana land manager in mind and includes publications useful when considering wildlife/sagebrush issues. Agency publications, meeting proceedings, books, and journal articles with specific information about Montana vegetation, soils, and wildlife are included. Non-published reports, environmental assessments, and environmental impact statements were not included.

The bibliography is divided into two parts:

PART I: MONTANA SAGEBRUSH

Part 1 provides the reader with important background information on Montana big sagebrush and also includes a key for the identification of the four subspecies of big sagebrush (*Artemisia tridentata*). A photo herbarium is also included to further assist with subspecies identification.

PART II: SAGEBRUSH BIBLIOGRAPHY

Part II consists of a numbered and alphabetized list of publications, subject index, and author index, providing the reader three different ways to review 451

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citations. Simply browse the bibliography for papers of interest or look for publications on a particular subject by referring to the subject index. For those who may have a particular reference in mind by author, we provided the author index.

This is a first attempt at a comprehensive sagebrush bibliography for Montana publications. We encourage comments for improving the usefulness of future editions. Send your comments and/or recommendations for additional publication inclusions to: *Mike Frisina, 1330 West Gold Street, Butte, MT 59701* or e-mail to: *frisina@montana.com*.



PART I: MONTANA SAGEBRUSH

Carl Wambolt, Professor
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Sagebrush (*Artemisia*) is arguably the most important genus of plants in the western United States. Sagebrush taxa occur on an estimated 109 million ha in the region (Beetle 1960, McArthur and Plummer 1978). Most of the more than 25 million ha of Montana rangeland contain at least 1 sagebrush taxon (Table 1). *Artemisia* is comprised of 200 to 300 species that are distributed throughout the world's temperate climates (McArthur and Plummer 1978, Beetle and Johnson 1982). The sagebrush that generally are most important are those that are widely distributed and/or often dominate their communities. Their domination is natural due to their adaptation for many of the environmental conditions present in the western United States. These dominant sagebrush taxa are in the natural section Tridentatae of *Artemisia*, which is an endemic group to western North America (Beetle 1960).

The most common species is big sagebrush (*Artemisia tridentata*). The genus and species for big sagebrush was given by Nuttall in 1841 to a specimen collected by him on the Snake River plain. Big sagebrush is also the most important sagebrush species due to the large areas its subspecies occupy and often dominate under natural conditions. Although the subspecies may occasionally be found growing together, generally they require different environmental conditions. Understanding of these requirements provides insight to the ecological variation that exists among the many communities occupied by big sagebrush.

It has been often stated that the land occupied by basin big sagebrush (*Artemisia tridentata tridentata*) could be farmed. That is the case because this subspecies occupies deep, well-drained soils usually found in valley bottoms or other locations where such soils occur.

At the other extreme among the big sagebrush taxa, Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) occupies the most xeric locations among the taxa. These sites are usually the product of shallower soils and a large amount of clay or sometimes silt in the soil profile. The taxon does not do well

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on coarse-textured soils.

Mountain big sagebrush (*Artemisia tridentata vaseyana*), like basin big sagebrush, requires more moisture than does the Wyoming subspecies. However, mountain big sagebrush usually obtains its moisture by growing in localities with greater amounts of precipitation, rather than occupying very deep soils like basin big sagebrush grows in. The actual range of soils occupied by mountain big sagebrush ranges from sandy through silty and clayey textures, and may often be cobbly. However, generally finer textured soils appear to be favored by the taxon. Compared to surrounding community types mountain big sagebrush usually occupies the deeper better-watered locations.

The fourth subspecies of big sagebrush, subalpine sagebrush (*Artemisia tridentata spiciformis*) is of minor importance in Montana, as it is only known to occur in southwestern Montana near the Idaho border. It is found in the Centennial Valley and at the mouth of Cabin Creek near Hebgen Lake. Although it may occur occasionally elsewhere in southwestern Montana, it must be considered rare. Originally this taxon was considered to be a high elevation form of mountain big sagebrush. Subalpine big sagebrush is the only subspecies known to commonly root-sprout.

For further information regarding sagebrush vegetative types in Montana, the Society for Range Management (1994) publication "Rangeland Cover Types of the United States" should be consulted.

At intervals during the last 70 years, burning of sagebrush communities has been a popular practice in attempts to improve livestock forage production. There is considerable evidence in Montana that additional herbaceous cover for livestock foraging is not always realized following sagebrush control. For further information on this aspect, consult the following publications (Blaisdell 1953, Daubenmire 1975, Peek et al. 1979, Anderson and Holte 1981, Kuntz 1982, McNeal 1984, Mangan and Autenrieth 1985, Sturges and Nelson 1986, Wambolt and Payne 1986, Fraas et al. 1992, Wambolt and Watts 1996, Wambolt et al. 2001).

Upon review of 29 journals and diaries written prior to the onset of heavy immigrant movement into the western United States and before the vegetation along the major trails was grazed by domestic animals, Vale (1975) concluded that the pristine vegetation of the region was usually dominated by shrubs and that stands of grass were largely confined to mesic locations such as valley bottoms and canyons. Vale (1975) stated "the original condition of the range has implications for management. As brush was abundant in times prior to livestock grazing, its dominance of the vegetation today cannot always be considered evidence of over-grazing. Moreover, attempts to eradicate brush and encour-

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age pure stands of grass cannot be justified in terms of reestablishing the "natural plant cover."

Sagebrush taxa provide needed habitat components for scores of other organisms, both plant and animal (Wambolt 1998). McArthur and Plummer (1978) provided an air of optimism for sagebrush taxa that have shrunk to somewhere near one-half of their original range, and the organisms that require them. They stated, "we predict that in the years ahead the much-maligned sagebrush will be regarded with increasing favor by land managers". The publication of this sagebrush bibliography and similar materials since their prediction serve as evidence to their wisdom.

Table 1. Sagebrush¹ (*Artemisia*) taxa found in Montana.

<u>Taxon</u>	<u>Common name</u>
<u>TRIDENTATAE (section of ASTERACEAE)</u>	
<i>A. arbuscula arbuscula</i>	low sagebrush
<i>A. cana cana</i>	plains silver sagebrush
<i>A. c. viscidula</i>	mountain silver sagebrush
<i>A. longiloba</i>	alkali sagebrush
<i>A. nova</i>	black sagebrush
<i>A. rigida</i>	scabland sagebrush
<i>A. tridentata tridentata</i>	basin big sagebrush
<i>A. t. wyomingensis</i>	Wyoming big sagebrush
<i>A. t. vaseyana</i>	mountain big sagebrush
<i>A. t. spiciformis</i>	subalpine big sagebrush
<i>A. tripartita tripartita</i>	tall threetip sagebrush
<i>A. t. rupicola</i>	Wyoming threetip sagebrush
<u>Non - TRIDENTATAE subshrubs and shrubs</u>	
<i>A. frigida</i>	fringed sagewort
<i>A. longifolia</i>	longleaf sage
<i>A. pedatifida</i>	birdfoot sage
<i>A. spinescens</i>	bud sage

¹ There are an additional 11 *Artemisia* taxa in Montana that grow as forbs and are not included in this table.



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KEY TO BIG SAGEBRUSH SUBSPECIES

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1. Tall plants (1 to 3 m at maturity), leaves long in relation to width and wedge shaped, panicles arise throughout a relatively uneven crown.

Basin big sagebrush (*Artemisia tridentata tridentata*)



Basin big sagebrush - Lightly browsed



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Basin big sagebrush - Heavily browsed

1. Plants generally less than 1 m tall, leaves not wedge shaped with bases strongly tapered.
2. Crown rounded with panicles arising throughout a relatively uneven crown, leaves are bell-shaped and shorter than other big sagebrush taxa.

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*)



Wyoming big sagebrush - Lightly browsed



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Wyoming big sagebrush - Heavily browsed

2. Crown flat-topped with panicles arising to relatively even lengths above the foliage.
3. Leaves intermediate in size, crown relatively compact.

Mountain big sagebrush (*Artemisia tridentata vaseyana*)



Mountain big sagebrush - Lightly browsed

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Mountain big sagebrush - Heavily browsed

3. leaves large, crown relatively open

Subalpine big sagebrush (*Artemisia tridentata spiciformis*)



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PHOTOGRAPHIC HERBARIUM

*Photographs Courtesy Carl L. Wambolt, Professor
Montana State University*

Artemisia tridentata tridentata
Basin big sagebrush



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Artemisia tridentata vaseyana Mountain big sagebrush



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Artemisia tridentata wyomingensis
Wyoming big sagebrush



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Artemisia tridentata spiciformis
Subalpine big sagebrush



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Photo: Michael R. Frisina



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Photo: C. L. Wambolt



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on rangelands in the western
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Wambolt, Walhof & Frisina
Journal of Environmental Management
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